

Claims

1
2 **Claim 1.** An agricultural implement, which is arranged for introducing materials into
3 the ground, wherein:
4 the implement includes a knife having an angled blade;
5 the implement includes a drawing means, for drawing the angled blade through the
6 ground in a forwards direction;
7 the angled blade is effective, when drawn through the ground, to create an angled slit-
8 opening in the ground;
9 the implement includes a conduit for conducting the materials to the angled blade;
10 the conduit is secured to the angled blade, and is so positioned thereon that, during
11 operation, a discharge mouth of the conduit is located in the ground at a depth
12 below the ground surface, and is so located in relation to the angled blade as to
13 deposit the materials directly behind the angled blade, in the slit-opening created
14 by the angled blade, as the knife is drawn through the ground;
15 the angled blade is formed with an over-surface and an under-surface, which intersect
16 at a line, and the line defines a knife-edge of the blade;
17 the implement includes a knife-mounting means;
18 the knife-mounting means is effective to mount the angled blade at such an orientation
19 and disposition in relation to the ground, during operation of the implement, that:
20 (a) when viewed from the forwards direction, the knife-edge makes an angle to
21 the horizontal, termed the side-slope-angle, of between 30 and 60 degrees;
22 and
23 (b) the angled blade extends down into the ground to a blade-depth of no more
24 than about 15 cm, measured vertically down from the ground surface.

25 **Claim 2.** As in claim 1, wherein the blade-depth is no more than about 10 cm.

26 **Claim 3.** As in claim 1, wherein the angled blade includes a below-ground portion,
27 which lies wholly below ground, during operation, and the line defining the knife-
28 edge is a straight line, when viewed in front elevation, over substantially the whole
29 of the below-ground portion of the blade.

30 **Claim 4.** As in claim 1, wherein the angled blade includes a below-ground portion,
31 which lies wholly below ground during operation, and the line defining the knife-

edge is a straight line, when viewed at right angles to the over-surface, over substantially the whole of the below-ground portion of the blade.

Claim 5 As in claim 1, wherein the side-slope-angle is about 45 degrees.

Claim 6 As in claim 5 wherein the side-slope-angle of the blade is constant over substantially the whole of the below-ground portion of the blade.

Claim 7. As in claim 1, wherein the blade is so mounted that, at a vertical cross-section of the blade, taken below the ground surface, substantially no point in or on the blade at that vertical cross-section is vertically lower in the ground than the knife-edge at that vertical cross-section.

Claim 8. As in claim 7, wherein the over-surface of the blade is so angled that, when the blade is drawn through the ground, ground-soil in the path of the over-surface is lifted upwards thereby.

Claim 9. As in claim 1, wherein:

the over-surface of the blade includes an upper-edge-surface, which is a portion of the over-surface that:

(a) is contiguous with the knife-edge;

(b) lies between the knife-edge and a line drawn on the over-surface parallel to the knife-edge and 4 cm back from the knife-edge; and

(c) lies between the bottom extremity of the knife-edge and the ground surface;

the upper-edge-surface is a unitary flat plane;

the knife-mounting means is effective to mount the angled blade at such an orientation and disposition of the knife in relation to the ground that a normal to the upper-edge-surface points upwards relative to the horizontal.

Claim 10. As in claim 1, wherein, when viewed in cross-section of the blade taken in a plane at right angles to the knife-edge, the upper-edge-surface of the blade lies at an angle, termed the wedge-angle of the upper-edge-surface of the blade, of between 14 and 45 degrees, and preferably between 20 and 30 degrees to the horizontal.

60 **Claim 11.** As in claim 10, wherein the wedge-angle of the upper-edge-surface of the
61 blade is about 25 degrees.

62 **Claim 12.** As in claim 10, wherein the wedge-angle of the upper-edge-surface of the
63 blade is substantially constant over a substantial area of the blade, being an area
64 of the blade below the ground surface.

65 **Claim 13.** As in claim 1, wherein, when viewed from the forwards direction, the over-
66 surface of the blade occupies a height, above the knife-edge, of between 6 cm
67 and 10 cm, measured vertically.

68 **Claim 14.** As in claim 1, wherein, when viewed from the forwards direction, the over-
69 surface of the blade occupies a height, above the knife-edge, of between 2.5 cm
70 and 4.5 cm, measured at right angles to the knife-edge.

71 **Claim 15.** As in claim 1, wherein:
72 the under-surface of the blade includes a lower-edge-surface, which is that portion of
73 the under-surface that:
74 (a) is contiguous with the knife-edge;
75 (b) lies between the knife-edge and a line drawn on the under-surface parallel to
76 the knife-edge and 4 cm back from the knife-edge; and
77 (c) lies between the bottom extremity of the knife-edge and the ground surface;
78 the knife-mounting means is effective to mount the angled blade at such an orientation
79 and disposition of the knife in relation to the ground that normals drawn from
80 substantially all points on the lower-edge-surface point downwards.

81 **Claim 16.** As in claim 15, wherein the under-surface is so disposed that, when the
82 knife is viewed in side elevation, during operation, a normal to the under-surface is
83 vertical or points slightly backwards from vertical.

84 **Claim 17.** As in claim 1, wherein the blade, as viewed in cross-section at right angles
85 to the knife-edge, is generally triangular in shape, the three sides of the triangle
86 being the said over-surface, the said under-surface, and a back-side of the blade.

87 **Claim 18.** As in claim 17, wherein the distance between the over-surface and the
88 under-surface at or adjacent to the back side of the blade is between 1.5 and
89 4.5 cm, and preferably between 2.5 and 4 cm.

90 **Claim 19.** As in claim 17, wherein the triangle is the same, as to size, shape, and
91 orientation, at all below-ground cross-sections at right angles to the knife-edge.

92 **Claim 20.** As in claim 1, wherein, over at least the portion of the blade that lies below
93 ground during operation, the conduit is structurally integrated into, or supported
94 upon, a back-side of the blade.

95 **Claim 21.** As in claim 20, wherein the blade is so structured that substantially no part
96 of the structure of the blade extends behind the conduit.

97 **Claim 22.** As in claim 20, wherein the over-surface and under-surface of the blade are
98 flat planes extending from the knife-edge right back to the conduit.

99 **Claim 23.** As in claim 20, wherein the conduit has walls, and the conduit has a
100 diametral dimension, inside the walls thereof, of between 10 mm and 25 mm.

101 **Claim 24.** As in claim 20, wherein the back-side of the blade, and the walls of the
102 conduit, lie parallel to the knife-edge, when viewed in front elevation.

103 **Claim 25.** As in claim 20, wherein the back-side, and the walls of the conduit, lie
104 parallel to the knife-edge, when viewed at right angles to the over-surface.

105 **Claim 26.** As in claim 20, wherein, in a cross-section of the blade taken in a plane at
106 right angles to the knife-edge, the blade measures between 5 cm and 10 cm in
107 width, from the knife-edge to a mid-point inside the conduit.

108 **Claim 27.** As in claim 1, wherein the knife-mounting means is effective to mount the
109 angled blade at such an orientation and disposition in relation to the ground,
110 during operation of the implement, that:
111 when viewed in lateral or side elevation, during operation, the knife-edge makes an

112 angle to the horizontal, termed the forward-pitch-angle, of between 30 and 60
113 degrees;
114 the blade slopes forwards in that view, whereby deeper portions of the knife-edge in
115 the ground lie ahead of more shallow portions of the knife-edge.

116 **Claim 28.** As in claim 27, wherein the forward-pitch-angle is 45 degrees.

117 **Claim 29.** As in claim 1, wherein the portion of the knife-edge below ground is
118 smooth and uninterrupted, in the sense that there is substantially nothing on the
119 knife-edge that would snag soil and debris passing upwards along the knife-edge,
120 during operation.

121 **Claim 30.** As in claim 1, wherein:
122 the knife includes an in-ground blade portion, an above-ground shank portion, and an
123 at-ground-surface transition portion;
124 the general shape and disposition of the knife is such that, during operation thereof,
125 soil and debris travelling up the knife-edge towards, and out of, the ground surface
126 is deflected aside from the shank portion.

127 **Claim 31.** As in claim 30, wherein:
128 the at-ground-surface transition portion of the knife is formed with a deflector-surface;
129 the deflector-surface is so orientated upon the knife as to be visible from in front, in a
130 horizontal front elevation, when the knife is operating in the ground;
131 when viewed in a lateral or side elevation of the knife during operation, a normal to the
132 deflector-surface points backwards and downwards;
133 the above-ground shank portion includes a front surface and a rear surface, and left
134 and right side surfaces, and the disposition of the knife is such that, during
135 operation, soil debris travelling up the knife-edge towards the ground surface
136 encounters the deflector-surface upon reaching the ground surface, and is
137 deflected aside by same, and is thereby deflected clear of the front surface of the
138 above-ground shank portion of the knife, and is deflected by same downwards
139 and is thereby at least somewhat inhibited from flying into the air.

140 **Claim 32.** As in claim 31, wherein the knife-edge and the deflector-surface are

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141 contiguous, and the knife is so configured that the knife-edge blends smoothly into
142 the deflector-surface without snags or interruptions.

143 **Claim 33.** As in claim 31, wherein:
144 the shank portion and the blade portion lie relatively at an angle, at or near the at-
145 ground-surface transition portion, and the deflector-surface lies on the outside of
146 the angle;
147 on the inside of the angle, the knife is smooth and has a configuration that resists
148 snagging of soil debris.

149 **Claim 34.** As in claim 31, wherein the deflector-surface extends no more than about
150 2 cm below the ground surface.

151 **Claim 35.** As in claim 1, wherein:
152 a frame of the implement includes a seeding-knife-mounting bar;
153 the knife is formed with an above-ground shank-portion, and the knife mounting
154 means includes an operable attachment means whereby the knife can be
155 detachably attached to the seeding-knife-mounting bar;
156 and the conduit is so positioned in relation to the shank-portion as to allow access for
157 operation of the attachment means.

158 **Claim 36.** As in claim 35, wherein:
159 the shank portion includes a front surface and a rear surface, and left and right side
160 surfaces;
161 in front view of the knife, the conduit lies in line with, and behind, the above-ground
162 shank-portion;
163 and the conduit is spaced from the rear surface by a distance that is enough to permit
164 access for operation of the attachment means.

165 **Claim 37.** As in claim 35, wherein:
166 the shank portion includes a front surface and a rear surface, and left and right side
167 surfaces;
168 and the conduit is located at one of the left and right side surfaces of the above-
169 ground shank-portion.

170 **Claim 38.** As in claim 1, wherein the implement includes a seeding hose, of flexible
171 material, and the conduit includes a port, for attachment thereto of the flexible
172 seeding hose.

173 **Claim 39.** As in claim 1, wherein:

174 the knife includes a wing-extension;

175 the wing-extension is formed with an over-surface and an under-surface, which

176 intersect at a line, and the line defines a wing-knife-edge of the wing-extension;

177 the knife includes a wing-mounting-means, which is effective to so mount the wing-
178 extension in relation to the angled blade that:

179 (a) the knife-edge of the blade and the wing-knife-edge meet contiguously, at a
180 point at the bottom of the knife-edge of the blade;

181 (b) the wing-knife-edge extends substantially horizontally from the said point;

182 (c) and the blade is so mounted that, at any vertical cross-section of the wing-
183 extension, substantially no point in or on the wing-extension at that vertical
184 cross-section is vertically lower in the ground than the wing-knife-edge at that
185 vertical cross-section.

186 **Claim 40.** As in claim 39, wherein the overall vertical thickness of the wing extension
187 is no more than 2 cm.

188 **Claim 41.** As in claim 39, wherein the wing-knife-edge forms a horizontal straight line,
189 which in plan view lies at right angles to the forwards direction.

190 **Claim 42.** As in claim 1, wherein:

191 the angled blade includes a promontory, which is effective, when the blade is drawn

192 through the ground, to cut a side ledge in the slit-opening;

193 the implement includes a second conduit for conducting a second material to the
194 angled blade;

195 the second conduit is secured to the angled blade, and is so positioned thereon that,
196 during operation, a discharge mouth of the second conduit is located in the
197 ground at a depth below the ground surface, and is so located in relation to the
198 angled blade as to deposit the second material directly behind the promontory,
199 and onto the side ledge, as the knife is drawn through the ground.

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200 **Claim 43.** As in claim 42, wherein:

201 the slit opening as cut by the angled knife blade, and the disposition of the discharge
202 mouth of the conduit, are such that the materials discharged from the conduit fall
203 to the bottom of the slit opening;
204 the side ledge as cut by the promontory, and the disposition of the second conduit,
205 are such that the second materials discharged from the second conduit fall onto
206 the side ledge.

207 **Claim 44.** As in claim 43, wherein the materials are seeds, and the second material is
208 fertiliser.

209 **Claim 45.** As in claim 1, wherein the materials are deposited on soil in the slit
210 opening that has substantially not been compressed by the passage of the angled
211 knife.

212 **Claim 46.** As in claim 44, wherein the second materials are deposited on soil in the
213 side ledge that has substantially not been compressed by the passage of the
214 promontory to the angled knife.

215 **Claim 47.** As in claim 1, wherein the implement includes a means for forcing air to
216 flow through the conduit, whereby particulate materials in the conduit are urged
217 along the conduit, and out of the discharge mouth, by the flow of air.

218 **Claim 48.** As in claim 1, wherein the implement includes an implement-frame, from
219 which the angled blade is suspended, and the drawing means includes a hitching
220 means whereby the implement-frame is hitched to a tractor.

221 **Claim 49.** As in claim 1, wherein a large number of the said knives are mounted on
222 the implement, each angled blade being so mounted as to be oriented and
223 disposed each in the manner as defined in claim 1, the large number being
224 eighteen or more.

225 **Claim 50.** As in claim 49, wherein, when viewed from the forwards direction, a
226 substantial proportion of the large number of knives are angled to the left, and the

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227 remainder thereof are angled to the right.

228 Claim 51. As in claim 1, wherein the implement includes a hopper, for storage of the
229 materials to be introduced into the ground, and the conduit is arranged to conduct
230 the materials from the hopper to the angled blade.

231 Claim 52. As in claim 49, wherein the implement includes press-wheels, one for each
232 angled knife, the press wheels being effective to roll over the soil lifted by the action of
233 the angled knives.

234 Claim 53. Agricultural knife apparatus, which is so structured as to be suitable for
235 inserting materials such as seeds into the ground, wherein:
236 the apparatus is structurally suitable for the operation of creating a slit-opening in the
237 ground and of inserting the materials into the slit-opening, at a depth that is less
238 than about 15 cm vertically below the ground surface;
239 the apparatus includes a shank and a blade, and includes a transition zone, at which
240 the shank and blade are joined integrally;
241 the shank includes a front surface and a rear surface, and left and right side surfaces;
242 when viewed in front elevation, the shank has an axis, termed the shank axis;
243 the blade is formed with an over-surface and an under-surface, which intersect at a
244 line, and the line defines an angled-knife-edge of the blade;
245 the shank axis intersects the line of the angled-knife-edge, at a point of intersection on
246 the angled-knife-edge;
247 when viewed in front elevation, the line of the angled-knife-edge slopes at an angle,
248 termed the knife angle, relative to the shank axis, and the knife angle is between
249 30 and 60 degrees;
250 the angled-knife-edge has a bottom extremity thereof, and the distance, measured
251 along the angled-knife-edge, from the point of intersection to the bottom extremity
252 of the angled-knife-edge, is less than about 30 cm.

253 Claim 54. As in claim 53, wherein the angled-knife-edge is a straight line.

254 Claim 55. As in claim 53, wherein the knife apparatus includes a conduit, which is
255 structurally suitable for depositing seeds in the ground, the conduit being attached

256 to, or supported upon, the blade on a back-side of the blade, which is opposite to
257 and remote from the knife-edge.

258 **Claim 56.** As in claim 53, wherein, in a cross-section of the blade portion taken in a
259 plane at right angles to the knife-edge, the over-surface and the under-surface
260 make an included angle of intersection of between 15 and 30 degrees.

261 **Claim 57.** As in claim 56, wherein the included angle of intersection is the same at
262 cross-sections taken in all planes between the point of intersection and the bottom
263 extremity.

264 **Claim 58.** As in claim 53, wherein the shank includes an attachment means for
265 attaching the knife apparatus to a mounting bar, the attachment means includes
266 two bolt holes, one above the other, in the shank, and the axis of the shank
267 passes through the bolt holes.

268 **Claim 59.** A seeding-knife assembly, comprising a body-member and a replaceable
269 tip-member, wherein:
270 the assembly comprises a knife having an angled blade assembly;
271 the body-member includes a body-over-surface and a body-under-surface, which
272 intersect at a line, and the line defines a body-knife-edge;
273 the tip-member includes a tip-over-surface and a tip-under-surface, which intersect at a
274 line, and the line defines a tip-knife-edge;
275 the shapes of the body-member and the tip-member, and the arrangement of the
276 assembly, are such that:
277 (a) the body-knife-edge terminates at a lower extremity thereof, and the tip-knife-edge
278 terminates at an upper extremity thereof;
279 (b) the lower extremity of the body-knife-edge is contiguous with, and co-linear with,
280 the upper extremity of the tip-knife-edge;
281 (c) the tip-over-surface is a continuation of the plane of the body-over-surface, and the
282 tip-under-surface is a continuation of the plane of the body-under-surface;
283 the body-member, as viewed in cross-section at right angles to the body-knife-edge, is
284 generally triangular in form, the three sides of the triangle being the said body-
285 over-surface, the said body-under-surface, and a body-back-side of the body-

286 member;
287 the tip-member, as viewed in cross-section at right angles to the tip-knife-edge, is
288 generally triangular in form, the three sides of the triangle being the said tip-over-
289 surface, the said tip-under-surface, and a tip-back-side of the tip-member;
290 the triangular form of the body-member is substantially identical to the triangular form
291 of the tip-member;
292 a first one of the members includes a spline, and the other includes a complementary
293 socket;
294 the spline and socket are so complementarily shaped that the tip-member can be
295 engaged on, and disengaged from, the body-member, and, when the tip-member
296 is fully engaged on the body-member, the tip-member is thereby held constrained
297 against all modes of rotational movement of the tip-member relative to the body-
298 member;
299 the assembly includes an operable release means;
300 the release means is effective to hold the tip-member fully engaged on the body-
301 member, and, when operated, is effective to release the tip-member from the
302 body-member.

303 **Claim 60.** As in claim 59, wherein:

304 the spline is a prism having the same general triangular shape as the first-member, but
305 is of a smaller size;
306 the disposition of the spline in the first member is such that a spline-back-side of the
307 triangular form of the spline lies in line with the back-side of the first member;
308 the socket in the second member is complementary to the triangular shape of the
309 spline, and comprises an open-backed hollow chamber of the second member;
310 the socket is positioned centrally within the back side of the second member, the
311 structure of the second member being such that the socket is defined by, and lies
312 between, upper and lower cheeks of the second member;
313 the disposition of the members is such that the upper and lower cheeks of the second
314 member overlie the spline, respectively above and below, when the tip-member is
315 fully engaged in the body-member.

316 **Claim 61.** As in claim 60, wherein the release means includes a pin, and includes a
317 pin-receiving-hole through at least one of the cheeks of the second member, and

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318 through the spline of the first member, and includes a means for retaining the pin
319 in the pin-receiving-hole during operation.

320 **Claim 62.** As in claim 59, wherein the first member is the body-member.

321 **Claim 63.** As in claim 59, wherein:
322 the implement includes a conduit for conducting seeds to the knife assembly;
323 the conduit is secured to the body-member, and is located at the body-back-side
324 thereof;
325 the conduit continues down from the body-back-side, and extends down the spline-
326 back-side;
327 a discharge mouth of the conduit is located at a lowermost extremity of the spline-
328 back-side.

329 **Claim 64.** As in claim 59, wherein the lower extremity of the body-knife-edge the knife
330 is rounded to a substantial radius in a convex sense, and the upper extremity of
331 the tip-knife-edge includes a tag, which is rounded complementarily in a concave
332 sense.

333 **Claim 65.** As in claim 59, wherein the body-knife-edge is sharp, having a radius of
334 less than about 0.5 mm, and the tip-knife-edge is more blunt, having a radius of
335 about 2 mm or more.

336 **Claim 66.** As in claim 59, wherein:
337 the replaceable tip-member includes a wing-extension;
338 the wing-extension is formed with an over-surface and an under-surface, which
339 intersect at a line, and the line defines a wing-knife-edge of the wing-extension;
340 the tip-member includes a wing-mounting-means, which is effective to so mount the
341 wing-extension in relation to the tip-member that:
342 (a) the tip-knife-edge and the wing-knife-edge meet contiguously, at a point at the
343 bottom of the tip-knife-edge;
344 (b) the wing-knife-edge extends at a substantial angle to the blade-knife-edge
345 from the said point.

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346 **Claim 67.** The replaceable tip of the assembly of claim 59, as a separate component.

347 **Claim 68.** A procedure for planting seeds in the ground, comprising:
348 creating a slit-opening in the ground, by drawing a knife blade, having a knife-edge,
349 through the ground;
350 simultaneously depositing the seeds in the slit opening, right behind the angled knife
351 blade;
352 maintaining the angled knife blade at a depth of no more than about 15 cm vertically
353 down into the ground;
354 while the knife blade is being drawn through the ground, maintaining the knife-edge at
355 an angle relative to the ground;
356 wherein:
357 in front view relative to the direction in which the knife blade is drawn, the knife
358 blade makes an angle relative to the ground, termed the side-slope-angle, of
359 between 30 and 60 deg to the horizontal,
360 in lateral elevation, the knife-edge makes an angle to the horizontal, termed the
361 forward-pitch-angle, of between 30 and 60 degrees, and the blade slopes
362 forwards in that view, in that deeper portions of the knife-edge in the ground lie
363 ahead of more shallow portions of the knife-edge.

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Claims, as presented for PCT Entry into USA

Claim 69. An agricultural implement, which is so structured as to be suitable for inserting granular materials into the ground, wherein:
the implement is structurally suitable for the operation of creating a slit-opening in the ground and of inserting the materials into the slit-opening;
the implement includes a knife having an angled blade;
the implement includes a drawing means, for drawing the angled blade through the ground in a forwards direction;
the angled blade is effective, when drawn through the ground, to create an angled slit-opening in the ground;
the implement includes a conduit for conducting the materials to the angled blade;
the conduit is secured to the angled blade, and is so positioned thereon that, during operation, a discharge mouth of the conduit is located in the ground at a depth below the ground surface, and is so located in relation to the angled blade as to deposit the materials directly behind the angled blade, in the slit-opening created by the angled blade, as the knife is drawn through the ground;
the angled blade is formed with an over-surface and an under-surface, which intersect at a line, and the line defines a knife-edge of the blade;
the implement includes a knife-mounting means;
the knife-mounting means is effective to mount the angled blade at such an orientation and disposition in relation to the ground, during operation of the implement, that:
(a) when viewed from the forwards direction, the knife-edge makes an angle to the horizontal, termed the side-slope-angle, of between 30 and 60 degrees;
and
(b) the angled blade extends down into the ground to a blade-depth of no more than about 15 cm, measured vertically down from the ground surface;
the blade is so mounted that, at a vertical cross-section of the blade, taken below the ground surface, substantially no point in or on the blade at that vertical cross-section is vertically lower in the ground than the knife-edge at that vertical cross-section;
the over-surface of the blade is so angled that, when the blade is drawn through the

33 ground, ground-soil in the path of the over-surface is lifted upwards thereby;
34 and the knife-edge is smooth and uninterrupted, in the sense that there is
35 substantially nothing on the knife-edge that would snag soil and debris passing
36 upwards along the knife-edge, during operation.

37 **Claim 70.** As in claim 69, wherein:

38 the over-surface of the blade includes an upper-edge-surface, which is a portion of
39 the over-surface that:

40 (a) is contiguous with the knife-edge;

41 (b) lies between the knife-edge and a line drawn on the over-surface parallel to
42 the knife-edge and 4 cm back from the knife-edge; and

43 (c) lies between the bottom extremity of the knife-edge and the ground surface;
44 the upper-edge-surface is a unitary flat plane;

45 the knife-mounting means is effective to mount the angled blade at such an
46 orientation and disposition of the knife in relation to the ground that a normal to
47 the upper-edge-surface points upwards relative to the horizontal.

48 **Claim 71.** As in claim 69, wherein, when viewed in cross-section of the blade

49 taken in a plane at right angles to the knife-edge, the upper-edge-surface of the
50 blade lies at an angle, termed the wedge-angle of the upper-edge-surface of the
51 blade, of between 14 and 45 degrees, and preferably between 20 and 30 degrees
52 to the horizontal;

53 and the wedge-angle of the upper-edge-surface of the blade is substantially constant
54 over a substantial area of the blade, being an area of the blade below the ground
55 surface.

56 **Claim 72.** As in claim 69, wherein:

57 the blade, as viewed in cross-section at right angles to the knife-edge, is generally
58 triangular in shape, the three sides of the triangle being the said over-surface,
59 the said under-surface, and a back-side of the blade.

60 **Claim 73.** As in claim 72, wherein the triangle is the same, as to size, shape, and

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61 orientation, at substantially all below-ground cross-sections at right angles to the
62 knife-edge.

63 **Claim 74.** As in claim 72, wherein, over at least the portion of the blade that lies
64 below ground during operation, the conduit is structurally integrated into, or
65 supported upon, the back-side of the blade.

66 **Claim 75.** As in claim 69, wherein the knife-mounting means is effective to mount
67 the angled blade at such an orientation and disposition in relation to the ground,
68 during operation of the implement, that:
69 when viewed in lateral or side elevation, during operation, the knife-edge makes an
70 angle to the horizontal, termed the forward-pitch-angle, of between 30 and 60
71 degrees;
72 the blade slopes forwards in that view, whereby deeper portions of the knife-edge in
73 the ground lie ahead of more shallow portions of the knife-edge.

74 **Claim 76.** As in claim 69, wherein:
75 the knife includes an in-ground blade portion, an above-ground shank portion, and
76 an at-ground-surface transition portion;
77 the general shape and disposition of the portions of the knife is such that, during
78 operation thereof, soil and debris travelling up the knife-edge towards, and out
79 of, the ground surface is deflected aside from the shank portion;
80 the above-ground shank portion includes a front surface and a rear surface, and left
81 and right side surfaces, and the disposition of the knife is such that, during
82 operation, soil debris travelling up the knife-edge towards the ground surface
83 encounters the deflector-surface upon reaching the ground surface, and is
84 deflected aside by same, and is thereby deflected clear of the front surface of the
85 above-ground shank portion of the knife, and is deflected by same downwards
86 and is thereby at least somewhat inhibited from flying into the air.

87 **Claim 77.** As in claim 69, wherein:
88 a frame of the implement includes a seeding-knife-mounting bar;

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89 the knife is formed with an above-ground shank-portion, and the knife mounting
90 means includes an operable attachment means whereby the knife can be
91 detachably attached to the seeding-knife-mounting bar;
92 and the conduit is so positioned in relation to the shank-portion as to allow access
93 for operation of the attachment means.

94 **Claim 78.** As in claim 69, wherein the implement includes a seeding hose, of
95 flexible material, and the conduit includes a port, for attachment thereto of the
96 flexible seeding hose.

97 **Claim 79.** As in claim 69, wherein:
98 the knife includes a wing-extension;
99 the wing-extension is formed with an over-surface and an under-surface, which
100 intersect at a line, and the line defines a wing-knife-edge of the wing-extension;
101 the knife includes a wing-mounting-means, which is effective to so mount the wing-
102 extension in relation to the angled blade that:
103 (a) the knife-edge of the blade and the wing-knife-edge meet contiguously, at a
104 point at the bottom of the knife-edge of the blade;
105 (b) the wing-knife-edge extends substantially horizontally from the said point;
106 (c) and the blade is so mounted that, at any vertical cross-section of the wing-
107 extension, substantially no point in or on the wing-extension at that vertical
108 cross-section is vertically lower in the ground than the wing-knife-edge at
109 that vertical cross-section.

110 **Claim 80.** As in claim 69, wherein:
111 the angled blade includes a promontory, which is effective, when the blade is drawn
112 through the ground, to cut a side ledge in the slit-opening;
113 the implement includes a second conduit for conducting a second granular material
114 to the angled blade;
115 the second conduit is secured to the angled blade, and is so positioned thereon that;
116 during operation, a discharge mouth of the second conduit is located in the
117 ground at a depth below the ground surface, and is so located in relation to the

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118 angled blade as to deposit the second material directly behind the promontory,
119 and onto the side ledge, as the knife is drawn through the ground;
120 the slit opening as cut by the angled knife blade, and the disposition of the discharge
121 mouth of the conduit, are such that the material discharged from the conduit
122 falls to the bottom of the slit opening;
123 the side ledge as cut by the promontory, and the disposition of the second conduit,
124 are such that the second material discharged from the second conduit falls onto
125 the side ledge.

126 **Claim 81.** As in claim 69, wherein:

127 a large number of the said knives are mounted on the implement, each angled blade
128 being so mounted as to be oriented and disposed each in the manner as defined
129 in claim 69;

130 the implement includes press-wheels, one for each angled knife, the press wheels
131 being effective to roll over the soil lifted by the action of the angled knives.

132 **Claim 82.** An agricultural knife apparatus, which is so structured as to be suitable
133 for inserting granular materials into the ground, wherein:

134 the knife apparatus is structurally suitable for the operation of creating a slit-opening
135 in the ground and of inserting the materials into the slit-opening;

136 the apparatus includes a shank and a blade, and includes a transition zone, at which
137 the shank and blade are joined integrally;

138 the shank includes a front surface and a rear surface, and left and right side
139 surfaces;

140 when viewed in front elevation, the shank has an axis, termed the shank axis;

141 the blade is formed with an over-surface and an under-surface, which intersect at a
142 line, and the line defines an angled-knife-edge of the blade;

143 the shank axis intersects the line of the angled-knife-edge, at a point of intersection
144 on the angled-knife-edge;

145 when viewed in front elevation, the line of the angled-knife-edge slopes at an angle,
146 termed the knife angle, relative to the shank axis, and the knife angle is between
147 30 and 60 degrees;

148 the angled-knife-edge has a bottom extremity thereof, and the distance, measured
149 along the angled-knife-edge, from the point of intersection to the bottom
150 extremity of the angled-knife-edge, is less than about 30 cm;
151 the apparatus includes a conduit, for depositing the granular material in the ground,
152 the conduit being attached to, or supported upon, the blade on a back-side of the
153 blade, which is opposite to and remote from the knife-edge.

154 **Claim 83.** As in claim 82, wherein, in a cross-section of the blade portion taken in
155 a plane at right angles to the knife-edge, the over-surface and the under-surface
156 make an included angle of intersection of between 15 and 30 degrees.

157 **Claim 84.** As in claim 82, wherein the shank includes an attachment means for
158 attaching the knife apparatus to a mounting bar, the attachment means includes
159 two bolt holes, one above the other, in the shank, and the axis of the shank
160 passes through the bolt holes.

161 **Claim 85.** An agricultural knife assembly, which is so structured as to be suitable
162 for inserting granular materials into the ground, wherein:
163 the knife assembly is structurally suitable for the operations of creating a slit-
164 opening in the ground and of inserting the materials into the slit-opening;
165 the knife assembly comprises a body-member and a replaceable tip-member;
166 the assembly comprises a knife having an angled blade assembly;
167 the body-member includes a body-over-surface and a body-under-surface, which
168 intersect at a line, and the line defines a body-knife-edge;
169 the tip-member includes a tip-over-surface and a tip-under-surface, which intersect
170 at a line, and the line defines a tip-knife-edge;
171 the shapes of the body-member and the tip-member, and the arrangement of the
172 assembly, are such that:
173 (a) the body-knife-edge terminates at a lower extremity thereof, and the tip-knife-
174 edge terminates at an upper extremity thereof;
175 (b) the lower extremity of the body-knife-edge is contiguous with, and co-linear
176 with, the upper extremity of the tip-knife-edge;

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177 (c) the tip-over-surface is a continuation of the plane of the body-over-surface, and
178 the tip-under-surface is a continuation of the plane of the body-under-surface;
179 the body-member, as viewed in cross-section at right angles to the body-knife-edge,
180 is generally triangular in form, the three sides of the triangle being the said
181 body-over-surface, the said body-under-surface, and a body-back-side of the
182 body-member;
183 the tip-member, as viewed in cross-section at right angles to the tip-knife-edge, is
184 generally triangular in form, the three sides of the triangle being the said tip-
185 over-surface, the said tip-under-surface, and a tip-back-side of the tip-member;
186 a first one of the members includes a spline, and the other includes a
187 complementary socket;
188 the spline and socket are so complementarily shaped that the tip-member can be
189 engaged on, and disengaged from, the body-member, and, when the tip-member
190 is fully engaged on the body-member, the tip-member is thereby held
191 constrained against all modes of rotational movement of the tip-member relative
192 to the body-member;
193 the assembly includes an operable release means;
194 the release means is effective to hold the tip-member fully engaged on the body-
195 member, and, when operated, is effective to release the tip-member from the
196 body-member.

197 **Claim 86.** As in claim 85, wherein:
198 the spline is a prism having the same general triangular shape as the first-member,
199 but is of a smaller size;
200 the disposition of the spline in the first member is such that a spline-back-side of the
201 triangular form of the spline lies in line with the back-side of the first member;
202 the socket in the second member is complementary to the triangular shape of the
203 spline, and comprises an open-backed hollow chamber of the second member;
204 the socket is positioned centrally within the back side of the second member, the
205 structure of the second member being such that the socket is defined by, and lies
206 between, upper and lower cheeks of the second member;
207 the disposition of the members is such that the upper and lower cheeks of the second

208 member overlies the spline, respectively above and below, when the tip-member
209 is fully engaged in the body-member.

210 **Claim 87.** As in claim 85, in association with an agricultural implement, wherein:
211 the implement includes a conduit for conducting seeds to the knife assembly;
212 the conduit is secured to the body-member, and is located at the body-back-side
213 thereof;
214 the conduit continues down from the body-back-side, and extends down the spline-
215 back-side;
216 a discharge mouth of the conduit is located at a lowermost extremity of the spline-
217 back-side.

218 **Claim 88.** A procedure for inserting granular material into the ground,
219 comprising:
220 creating a slit-opening in the ground, by drawing a knife blade, having a knife-
221 edge, through the ground;
222 simultaneously depositing the material in the slit opening, right behind the angled
223 knife blade;
224 maintaining the angled knife blade at a depth of no more than about 15 cm
225 vertically down into the ground;
226 while the knife blade is being drawn through the ground, maintaining the knife-edge
227 at an angle relative to the ground;
228 wherein:
229 in front view relative to the direction in which the knife blade is drawn, the
230 knife blade makes an angle relative to the ground, termed the side-slope-
231 angle, of between 30 and 60 deg to the horizontal,
232 in lateral elevation, the knife-edge makes an angle to the horizontal, termed the
233 forward-pitch-angle, of between 30 and 60 degrees, and the blade slopes
234 forwards in that view, in that deeper portions of the knife-edge in the ground
235 lie ahead of more shallow portions of the knife-edge.